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CLAIMS

[Claim(s)]

[Claim 1] It consists of the circuit section (15) for detecting the zero crossover of the alternating current analog output electrical potential difference of a change form capacitor filter (3). This circuit section (15) The smoothing filter which is connected to the output of said change form capacitor filter (3), and generates an analog AC signal (20), The comparator (12) which compares said analog AC signal and reference level is included. Further said circuit section (15) It has a means to detect direct-current offset of said analog AC signal. This means The zero crossover detector circuit of the alternating current analog voltage characterized by supplying said direct-current offset which is connected to said comparator (12) and specifies said reference level to said comparator (12).

[Claim 2] The zero crossover detector circuit according to claim 1 where said means is equipped with the low pass filter (21) connected to the output of said change form capacitor filter (3).

[Claim 3] The cut off frequency (f1) of said smoothing filter (20) is the sampling frequency of said change form capacitor filter (3) (fS). It is smaller than one half, and the cut off frequency (f2) of said low pass filter (21) is the frequency of said analog AC signal (fI). Far low zero crossover detector circuit according to claim 2.

[Claim 4] Said comparator (12) has the 1st input and 2nd input. Said smoothing filter (20) is directly arranged between the output of said change form capacitor filter (3), and said 1st input of said comparator (12). And the zero crossover detector circuit according to claim 1, 2, or 3 where said means is directly arranged between the output of said change form capacitor filter (3), and said 2nd input of said comparator (12).

[Claim 5] Said smoothing filter (20) and said low pass filter (21) It consists of RC filters containing resistance (22 24) and a capacitor (23 25), respectively. Each aforementioned resistance (22 24) It is arranged, respectively between the output of said change form filter (3), and each input of said comparator (12). And each aforementioned capacitor (23 25) Claims 2 and 3 arranged between each input of said comparator (12), and reference potential Rhine of this comparator (12), or the zero crossover detector circuit of four publications.

[Claim 6] The zero crossover detector circuit according to claim 5 where said resistance (22 24) of said smoothing filter (20) and said low pass filter (21) has the same resistance (R).

[Claim 7] The zero crossover detector circuit according to claim 5 or 6 where said capacitor (25) of said low pass filter (21) has capacitance (C2) far higher than said capacitor (23) of said smoothing filter (20).

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the zero crossover detector circuit for detecting the zero crossover of the alternating current analog output electrical potential difference of a change form capacitor filter.
[0002]
[Description of the Prior Art] The detector circuit of the above-mentioned type is used for the receiving filter in the transmission system of the digital data transmitted by amplitude modulation and PSK (Phase Shift Keying, phase modulation) coding in analog mode. Such data include traffic, a weather report, and the auxiliary information about an available radio station, and are superimposed by the usual radio signal (carrier). At the time of reception, this auxiliary signal (information) on which it was superimposed is extracted from an input signal, and is sampled with a change form capacitor filter. Subsequently, the so-called smoothing filter graduates and information is reproduced by removing the sampling frequency of a high frequency component or a large number. And the processing for identifying coding binary information is made further. In order to check especially the phase shift "pi" (phase inversion) about the information (0 or 1 bit) coded by the sine wave on the occasion of this processing, it is necessary to determine the zero crossover of the graduated signal.
[0003] For this reason, the receiver equipped with the zero crossover detector circuit containing the smooth section and a zero crossover detecting element is installed in the interior. Drawing 2 is the simplified electrical diagram showing the conventional zero crossover detector circuit. Hereafter, explanation of drawing 2 is given simply.
[0004] 1 and 2 in drawing 2 show the signal smooth section and a zero crossover detecting element, respectively. Input signal Vi The signal smooth section 1 which receives consists of a well-known change form capacitor (it is written as SC Switched-Condenser and the following) filter 3, and a smoothing filter 4. This smoothing filter 4 has the resistance 5 connected between the output of the SC filter 3, and the output of the signal smooth section 1, and the capacitor 6 arranged between the output of the signal smooth section 1, and a ground. The output of the signal smooth section 1 is connected to the noninverting input of the buffer amplifier 8, and the output of this buffer amplifier 8 is connected to the input of the zero crossover detecting element 2. Furthermore, the zero crossover detecting element 2 has the input capacitor 10 between the input of this detecting element 2, and the noninverting input of the buffer amplifier 11. The output of the above-mentioned buffer amplifier 11 is connected to the noninverting input of the comparator 12 for zero crossover detection while connecting with the reversal input of itself. The reversal input of this comparator 12 is a reference potential VREF. It connects and that node is connected to the noninverting input of the buffer amplifier 11 through resistance 13. Furthermore, although the voltage source 14 located between the noninverting input of amplifier 11 and the end of resistance 13 is illustrated, this voltage source 14 expresses the direct-current offset voltage of the buffer amplifier 11 with drawing 2 .
[0005] Analog information is supplied only when the SC filter 3 has the defined value with the filter (smoothing filter 4) of a downstream in this continuous time circuit on behalf of a continuous time circuit. namely, -- according to the sampling theory -- the sampling frequency of the SC filter 3 -- fS it is -- a case -- a smoothing filter 4 -- the low-pass form of a cut off frequency fT (fT <fS / 2) -- it must be . Furthermore, the signal graduated by the above-mentioned filter 4 is supplied to a zero crossover detecting element, in order to identify a coding information bit. The signal with which the above was graduated in the well-known zero crossover detecting element shown in drawing 2 in order to guarantee the dependability of detection of a zero crossing is the reference voltage VREF of a comparator 12. Bias is received and carried out. The approach of this bias is performed by applying direct current voltage equal to the above-mentioned reference voltage to the

alternating current component of a signal.
[0006]
[Problem(s) to be Solved by the Invention] However, the well-known solution in drawing 2 makes it possible to determine a zero crossover correctly, only when there is no direct-current offset in the upper section from a comparator 12. When there is direct-current offset in the upper section (in this case, represented with the buffer amplifier 11) so that it may happen in the usual case if it puts in another way, the information supplied by the comparator 12 is inaccurate. Especially, they are V1, V2, V3, and eO. And I+ A definition is given as follows. Namely, V1 It considers as the alternating current component of the graduated signal in the input of the zero crossover detecting element 2, and is V2. It considers as the analog output signal of the buffer amplifier 11, and is V3. When there is no direct-current offset (V3 =V1+VREF), it considers as the analog output signal of the buffer amplifier 11 which will be obtained. Furthermore, eO It considers as the direct-current offset voltage of the buffer amplifier 11, and is I+. It considers as the bias current of the buffer amplifier 11. Offset vO produced with amplifier 12 at this time It is expressed like a degree type.
vO =-I+-eO So, it is V2 =V3+vO =V1+VREF-I+-eO. As a result, as shown in drawing 3 , it is the actual output signal V2. Reference voltage VREF Even if it compares, an exact zero crossing cannot be determined. And the error generated in the upper section from a comparator is added to the offset produced in comparator 12 itself. Consequently, the precision of the circuit at the time of seeing synthetically gets still worse.
[0007] This invention is made in view of the above-mentioned trouble, and it aims at offering the zero crossover detector circuit which enables highly precise actuation compared with a well-known solution.
[0008]
[Means for Solving the Problem and its Function] According to this invention, it consists of the circuit section for detecting the zero crossover of the alternating current analog output electrical potential difference of SC filter. This circuit section The smoothing filter which is connected to the output of said SC filter, and generates an analog AC signal, The comparator which compares said analog AC signal and reference level is included. Further said circuit section It has a means to detect direct-current offset of said analog AC signal. This means The zero crossover detector circuit of the alternating current analog voltage characterized by supplying said direct-current offset which is connected to said comparator and specifies said reference level to said comparator is offered.
[0009] He is trying to detect certainly direct-current offset of the analog AC signal graduated by the smoothing filter through direct-current offset detection means, such as a low pass filter, in this invention. In this way, in this invention, the zero crossover detector circuit which enables highly precise actuation compared with a well-known solution can be offered.
[0010]
[Example] Drawing 1 is the simplified electrical diagram showing one example of this invention. Hereafter, this invention is explained to a detail using this example. In drawing 1 , 15 shows the whole circuit section of this invention. This circuit section 15 is connected to the SC filter 3. Furthermore, this SC filter 3 is connected to the smoothing filter (low pass filter) 20 and the low pass filter 21, and each of these low pass filters 20 and 21 is connected to each input of the comparator 12 for zero crossover detection, respectively.
[0011] A filter 20 has resistance 22. This resistance 22 is connected to the serial between the output of the SC filter 3, and the noninverting input of a comparator 12. Furthermore, the capacitor 23 is connected between this noninverting input and ground (reference potential Rhine). Moreover, by one side, a filter 21 has resistance 24. This resistance 24 is connected to the serial between the output of the SC filter 3, and the reversal input of a comparator 12. Furthermore, the capacitor 25 is connected between this reversal input and ground. Both above-mentioned resistance 22 and resistance 24 have the same resistance.
[0012] Here, the resistance of two resistance 22 and 23 is set to R, and it is the capacitance of a capacitor 23 C1 It carries out and is the capacitance of a capacitor 25 Then, the cut off frequency f1 of filters 20 and 21 and f2 It is expressed like a degree type, respectively. C2
f1 =1/(2piRC1)
f2 =1/(2piRC2)
[0013] Especially the filter 20 forms a smoothing filter and a filter 21 forms the low pass filter for detecting direct-current offset (zero level of the graduated analog AC signal) of the output signal from the SC filter 3. According to the sampling theory, such a filtering function is attained by forming a degree type.
f1 <fS / 2 concrete targets should just be provided with the analog AC signal with which it graduated for coding binary information by the noninverting input of a comparator 12. It is also required to form a degree type further again.
f2 <<fI Here, it is fI. Analog AC signal Vi It is a frequency, namely, is the frequency of the graduated analog signal

in a downstream from a smoothing filter 20.
[0014] As a matter of fact, the conditions of the two above-mentioned formulas are equivalent to the conditions of a degree type.
f2 <<f1 And since both the resistance 22 and 24 has the same resistance, the conditions of a degree type are drawn.
C2 >>C1 [0015] So, according to this invention, direct bias is carried out to the reversal input of a comparator being also at the zero level (direct-current offset) of the alternating current output signal of a smoothing filter 20. And the above-mentioned reversal input is correctly connected with the direct-current level which exists in the own output of a smoothing filter. If it puts in another way, in the circuit of this invention, direct-current offset of the signal graduated by the filter 20 will be extracted through a filter 21. Therefore, if the above-mentioned direct-current offset is used as criteria of a comparator 12, it will become possible to determine a zero crossover as accuracy more with this comparator 12 (except for the own direct-current offset of a comparator). In fact, it is also possible by carrying out direct detection of the direct-current offset of the output signal from the SC filter 3 to compare the above-mentioned output signal with the above-mentioned offset (for the zero level of a signal to be meant as mentioned already) regardless of upstream each part from a comparator regardless of the cause of the offset [itself].
[0016] Bias current I+ [in / by preparing two resistance 22 and 24 which moreover has the same (having with 1/1000 or more accuracy by using current integration) resistance / two inputs of a comparator 12], I - Since it becomes the almost same value, it becomes possible to decrease offset of comparator 12 self.
[0017] The advantage of the circuit of drawing 1 will become clear by description to be described from now on. First, it is also set to one of the factors that the buffer stage (refer to drawing 2) which was the description in a well-known solution was removed, and it becomes possible [improving sharply the precision at the time of detecting a zero crossover] in this circuit the 1st.
[0018] Since the above-mentioned circuit is remarkably easy to design for the 2nd, it has the description of there being few component parts compared with a well-known solution, and ending. For this reason, the dependability on manufacture improves and a manufacturing cost also becomes cheap.
[0019] It can integrate enough by current using it for the 3rd (finally) in the above-mentioned circuit, and adopting the frequency on which integration of a capacitor may be performed.
[0020] however, probably, it will be clear for this contractor that the circuit's which explained here or was illustrated it is possible to change into versatility, without deviating from the range of this invention.
[0021]
[Effect of the Invention] As explained above, the zero crossover detector circuit which according to this invention enables actuation highly precise than before since he is trying to extract certainly direct-current offset of the analog AC signal which prepared two filters in the circuit and was graduated by the smoothing filter of the method of one through the low pass filter of another side is realizable.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the simplified electrical diagram showing one example of this invention.
[Drawing 2] It is the simplified electrical diagram showing the conventional zero crossover detector circuit.
[Drawing 3] It is the signal waveform diagram showing several sorts of signals in the configuration of drawing 2 .
[Deseription of Notations]
1 — Signal smooth section
2 — Zero crossover detecting element
3 — Change form capacitor filter
12 — Comparator
15 — Circuit section
20 — Smoothing filter
21 — Low pass filter
22 — Resistance
23 — Capacitor
24 — Resistance
25 — Capacitor

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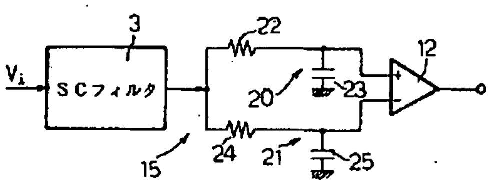
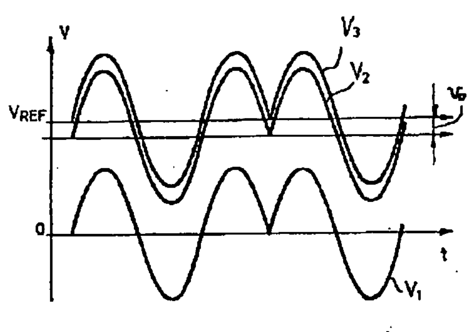
DRAWINGS

[Drawing 1]
本発明の一実施例を示す簡略化された電気回路図

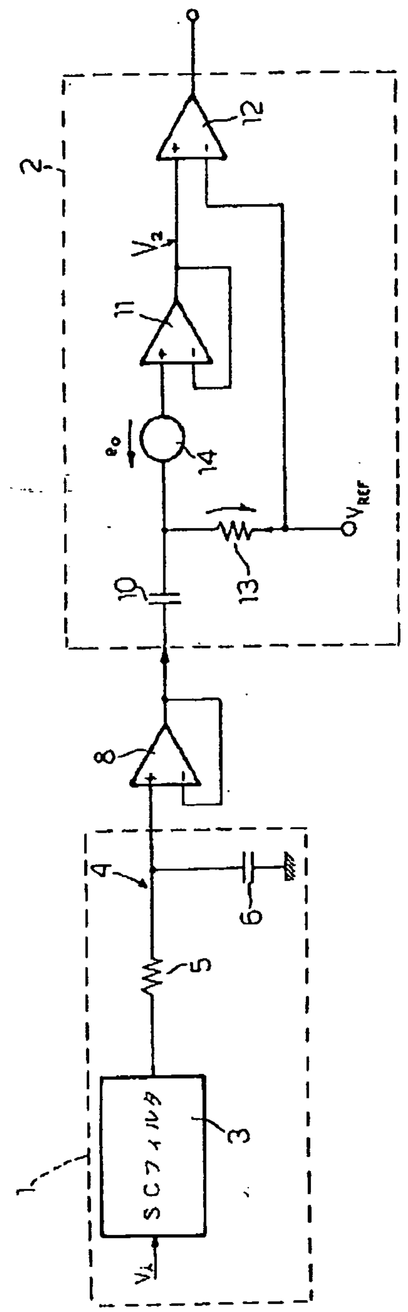


[Drawing 3]
図2の構成における数種の信号を示す信号波形図



[Drawing 2]

従来の零交差検波回路を示す簡略化された電気回路図



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